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ABSTRACT

Seven components of an authoring system for interactive computer-assisted instruction are described: (1) hardware, including a microcomputer, monitors, and a videodisc player; (2) videodiscs purchased for "repurposing," i.e., using frames of clips from the videodisc to illustrate the instructional program; (3) program options for the instructor; (4) the levels of questioning that can be used; (5) program options for the student; (6) output files which collect and profile the instructor's strategy and student responses; and (7) a manual for the student-author to use in preparing an interactive computer-assisted instruction module using the videodisc. Brief descriptions are provided of the users of the system, who are primarily graduate and undergraduate education students at Wayne State University (Michigan), and some general impressions of the system conclude this paper. Appendixes contain diagrams of system components, menu options, sample file profiles, and representative analyses of student response data. (MES)

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AN AUTHORING SYSTEM

USING VIDEODISCS

by

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March 4, 1988

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

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Paper presented at annual conference of the Michigan Association for Computer Users in Learning, Grand Rapids, Michigan, March 4, 1988.

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This project has been developing during the past three years. It is based upon many of the ideas which were initiated in developing computer assisted instruction languages such as PILOT, Instructional Dialogue Facility by Hewlett-Packard, and the extensive work on PLATO conducted at the University of Illinois. In the spirit of these CAI languages, this authoring system also attempts to simplify access to the information processing power of the computer for teachers and other instructors.

Hardware: Figure 1 illustrates the major components in the system, which uses a B-25 microcomputer, two monitors and a Pioneer Videodisc Player (Model V6000). The system includes an AUTHOR program which provides a variety of options for the instructor to create a USER program file. The STUDENT program is run by the pupil, whose responses are collected and summarized in two OUTPUT files, which provide raw data for further analysis as the instructor may choose.

Although the system was written for the B-25 microcomputer, we have also written versions for systems which use MS-DOS 3.2 and for the Macintosh Plus operating system. Documentation for the B-25 system is completed and we expect to complete documentation for the other two systems by the end of July 1988.

Videodiscs: We have followed the procedure of "repurposing" videodiscs. That is, we have purchased videodiscs which have been produced for one purpose and then we selected single frames or movie clips from that videodisc to illustrate our instructional program.

North American Philips' videodisc portraying the life and works of Vincent Van Gogh was a very useful videodisc for our purpose. The excellent narration by Leonard Nimoy and the artist's work are captivating. This videodisc lends itself well to our repurposing activities.

Optical Data Corporation has produced some excellent videodiscs which are intended to support instruction in K-12 schools and in colleges. Several of our students have used their "Earth Science" videodisc. Recently, they've released "Principles of Biology" and "Physical Science" videodiscs which are appealing to our students.

We've made limited use of the encyclopedia collection provided in Grolier's "Knowledge Disc." This videodisc could be valuable in supporting the instructional program, as reported by other writers. We simply haven't had sufficient time and opportunity to develop this resource.

AUTHOR Program: In this authoring system, we've provided a menu of options for the instructor who may press one of the function keys on the keyboard (F1, F2, ...) to select an option. As shown in Figure 3, function key F7 permits the instructor to browse through the videodisc to view single frames or movie clips. After viewing the videodisc sufficiently, the instructor may exit and prepare to create his/her instructional program.

Text may be presented on the micro's screeen (F6) to explain to the pupil what will occur and how to respond. Single frames (F1) from the videodisc or movie clips (F1-shifted)

may be presented to the pupil on the videodisc player's monitor. Pupils may view these visuals as often as they wish. The pupil has control of the flow of the program.

Questioning Strategies: Three levels of questioning are provided in this system. For a multiple-choice type question (F4), one answer is presumed to be correct and all other alternative answers are presumed to be incorrect. In the multiple-response type question (F5), one answer may be correct but a separate response is to be presented for each of the available responses which a pupil might choose. This also provides an opportunity for branching (F8 or F9) to another part of the program. The essay type question (F6) provides an opportunity for narrative statements to be typed by the pupil to explain or comment upon some aspect of the program. A primitive form of dialogue is possible through checking for key terms in a pupil's response to an essay type question. We have also provided the option to display individual figures or graphics (F2) on the micro's screen.

These opportunities within the AUTHOR system have raised problems for the instructor as to presentation and questioning strategies to use. That is, the instructor must decide which text, visuals, and questions must be presented at various times and their sequence. Furthermore, the instructor must decide whether or not to create and use additional graphics and th extent to which branching forward or backward will be permitted.

We've written a manual which describes several questioning strategies which our student-authors may use, and a great many others are available. We choose to limit the discussion of

the alternatives in the manuual and in this paper for sake of brevity and not for lack of interest or opportunity.

STUDENT Program: In operation, the pupil executes the STUDENT program and calls for the instructor's program by its name. The pupil may browse through the various frames on the videodisc or may be limited to reviewing only those frames selected by the instructor's program.

Multiple-choice and multiple-response type questions call for numeric responses from the pupils, and the keyboard is locked to prevent any other replies to these questions.

However, essay type questions call for the full range of alphanumeric characters and the arrow keys permit the pupil to move to statements on the screen and change the wording of their replies. Essay type questions permit answers to include three full screens of 25 lines of text and 70 characters per line.

Output Files: All responses of pupils are collected in an output file which is tagged at the end with the name of the file created by the instructor, e.g., OUTPUT.volcanism. For each pupil, the system records that person's answer to each question and the exact wording of their reply to each essay question.

A second file, OUTPUT2.filename, records each pupil's response as correct (1's), incorrect (0's), no response (blank), or essay question (.).

These two files are available for detailed analysis by the RESULTS and CHITEST programs. They provide conventional descriptive statistics, item analysis summaries, and may provide chi-square tests of group data or item responses. These additional programs are shown in the system flowchart in Figure 2.

The PROFILE program uses the instructor's program as input data and sketches a sequential portrait of the instructor's strategy for presenting text, visuals, and using various questioning opportunities.

AUTHOR Manual: A manual has been written for the student-author to use in preparing an interactive CAI module using the videodisc. In addition to a general description of interactive CAI, there is a discussion of the three questioning options available in this system and illustrations of each. A section of the manual illustrates a few of the questioning strategies, including presentation of text, single frame, movie clips, and other functions.

Blank forms are provided in the manual to guide the student-author in using the various options available in this system. Examples of programs completed by other student-authors serve as basic models of ways to utilize the system to create an instructional module.

User Groups: The primary users of this system have been undergraduate and graduate students enrolled in computer applications classes in the College of Education, Wayne State University. They may be experienced teachers pursuing

graduate work or pre-service students. Approximately 50 student-authors have used the system and we've modified it according to their experiences.

Typically, the student-author will select a topic in their major field or area of interest. They choose a chapter in a school textbook and direct their programs to provide the pupils with **enrichment** or **reinforcement** of one of the generalizations presented in that chapter of the textbook.

Lab time is scheduled by the student-authors in 45-minute blocks of time, when it is convenient for them. They view various frames or frame sequences which appear to be useful to their presentation.

Using blank forms provided in the manual, each student-author prepares a written copy of their program, before coming to the AUTHOR system to enter the statements. Then, it's simply a matter of selecting the authoring functions and typing their statements at the micro's keyboard. They may edit their programs as necessary and the FORMCHEK program will scan it to identify errors which may have been introduced in the editing process and which would prevent pupils from using the STUDENT program with it.

General Impressions to Date: This system has enabled us to explore the use of the videodisc as a mechanism for illustrating topics and processes ordinarily taught in K-12 schools. We share the enthusiasm for use of the videodisc for interactive CAI, which other authors have reported in the literature and at professional meetings. In particular, we have been impressed with the high quality of videodiscs and the

topics made available for our use by the Optical Data Corporation.

In our limited efforts, we've been intrigued with the opportunity to study the instructional strategies used by experienced teachers and by pre-service students. The PROFILE program provides a bar graph to summarize the various instructional options used by each student-author, e.g., text to explain, single frame, multiple-choice questions, essay questions. The flowchart of the instructional strategies show various clusters or patterns. Sometimes, questions are held until the end of the program and then a barrage of questions will unfold. For some student-authors, the text and illustrations and questions are knitted together neatly throughout the program.

As we expected, there has been a great variety in the complexity of questions posed by student-authors. Some will ask for simple repetition of ideas presented in a preceding frame, while others ask for explanations and justification for each answer given by the pupil.

At this time, our samples are too small to permit us to do more than speculate upon possible benefits of this author system and our efforts. For us, this project re-emphasizes the importance of individual styles which an instructor assumes in the process of organizing and presenting instruction. We're not in a position to say which is right or wrong. The empirical testing of any instructional program with representative samples of pupils for whom it was intended will provide the basic fuel for that evaluation. We believe that this authoring system will enable us to contribute to the identification of suitable uses of videodiscs with interactive computer assisted instruction.

FIGURES

Figure 1 - SYSTEM COMPONENTS IN B-25 AUTHOR SYSTEM USING VIDEODISC PLAYER

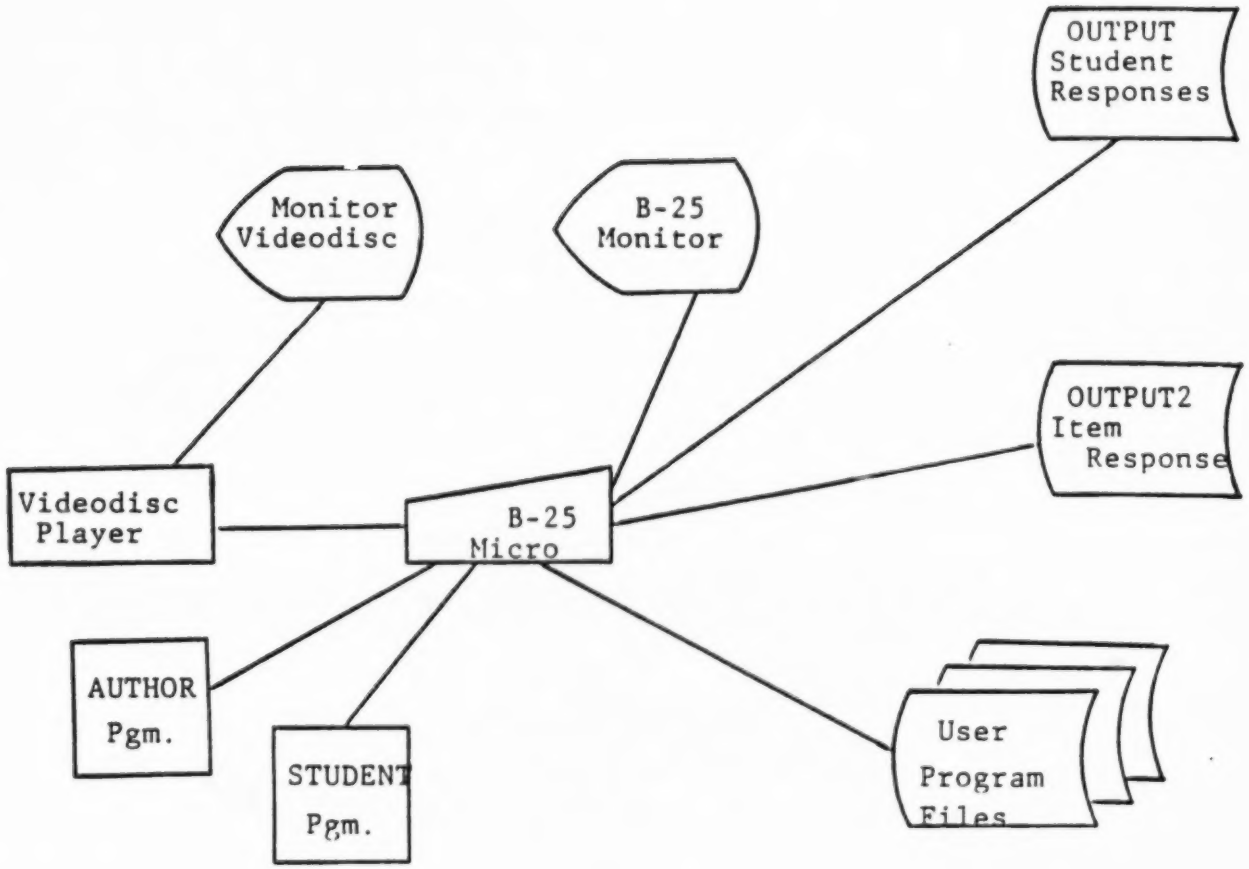


Figure 2 - 1987 VERSION OF AUTHOR SYSTEM WITH PROGRAMS WRITTEN TO ANALYZE INSTRUCTIONAL OUTPUT

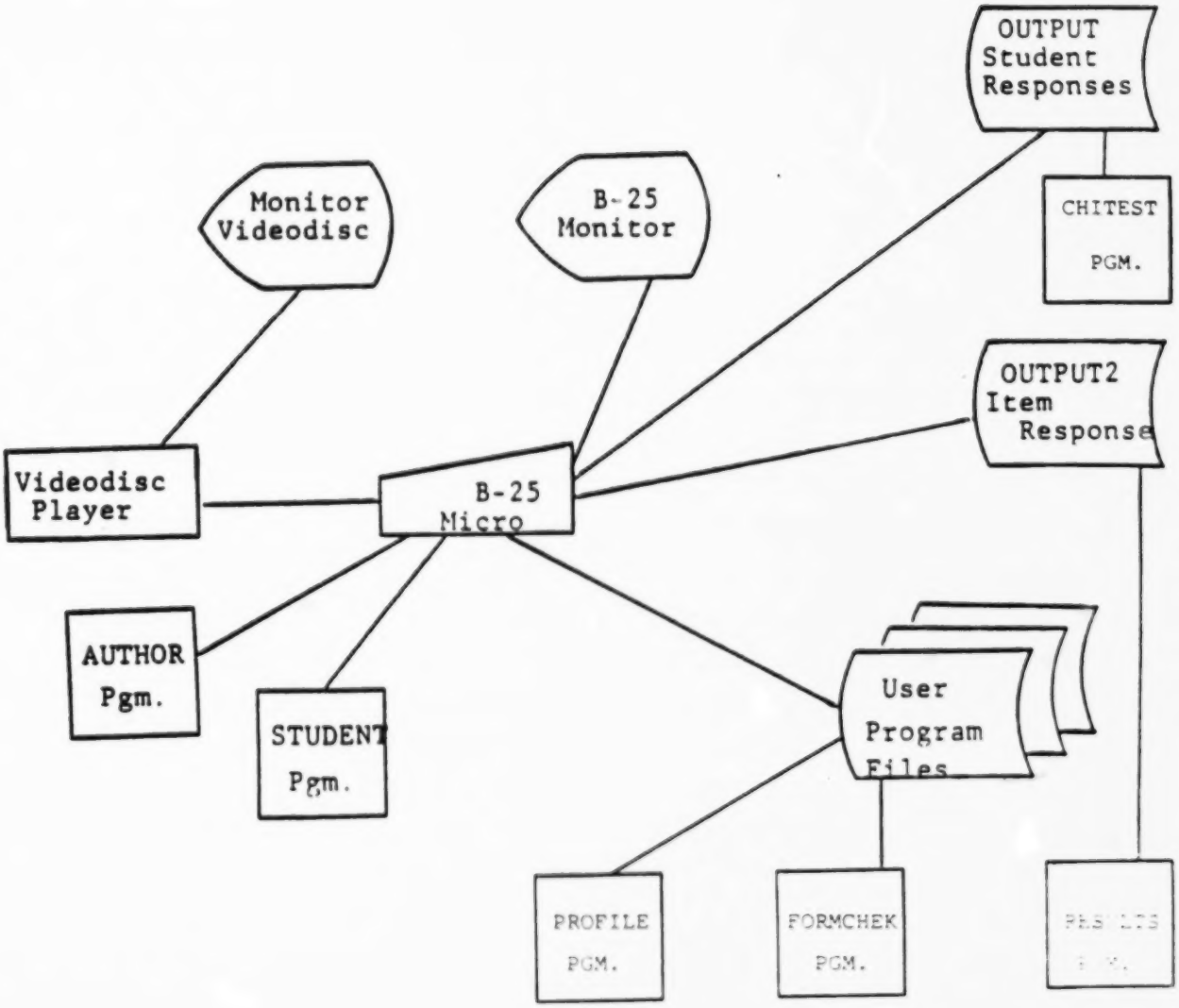


Figure 3 - MENU OF OPTIONS AVAILABLE THROUGH USE OF FUNCTION KEYS (F1, F2, ...)

Select one of the options listed below by pressing the key (HELP, F1 - F10) corresponding to that option.

HELP KEY - A guide to using this program
F1 - Enter a sequence of individual frames
F1 - [SHIFTED] Enter a videodisc presentation
F2 - Enter a graphic screen
F2 - [SHIFTED] Supress redisplay of graphic screen
F3 - Enter an open-ended question
F4 - Enter a multiple-choice question
F5 - Enter a multiple-response question
F6 - Enter a statement
F7 - Operate laser disc (if connected)
F8 - Enter a conditional branch
F8 - [SHIFTED] Enter a section number
F9 - Enter an unconditional branch (jump)
F9 - [SHIFTED] Reset correct response counter
F10- Exit from the program

F1

PRESS KEY 1 TO 9 TO SELECT THE NUMBER
OF THE FRAMES YOU WISH TO HAVE PRESENTED
IN CONSECUTIVE ORDER
SECTION = 1

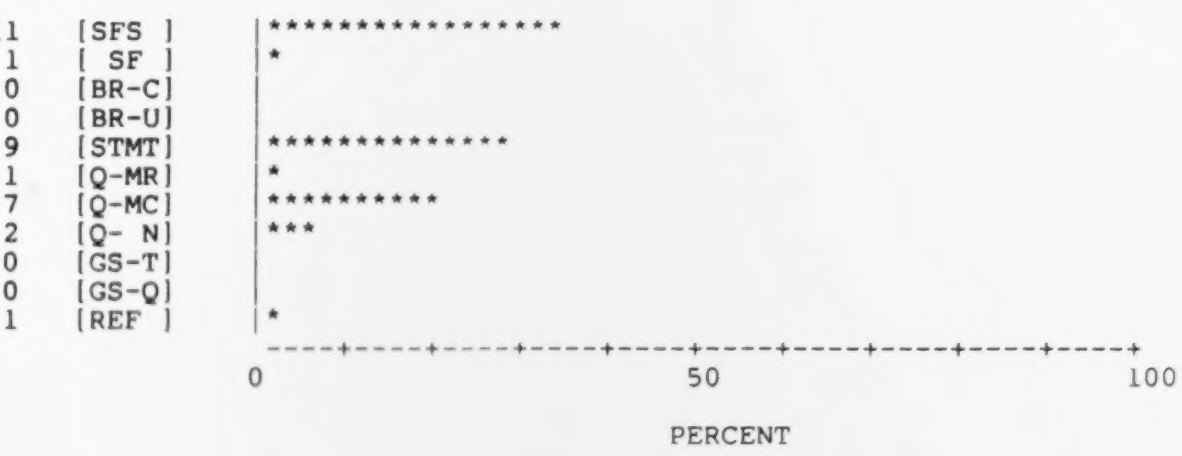
APPENDIX

SAMPLE PROFILES

PROFILE OF FILE [d2]<tue>rocks

NUMBER OF LINES IN FILE :338
NUMBER OF SECTIONS IN FILE: 30

FREQUENCY & PERCENT OF COMMANDS USED IN FILE



LEGEND

[SFS] A frame sequence(presentation).

[SF] One or more single frames.

[BR-C] Conditional branch.

[BR-U] Unconditional branch

[STMT] Statement(instruct or explain).

[Q-MR] Multiple response question.

[Q-MC] Multiple choice question.

[Q- N] Open ended question.

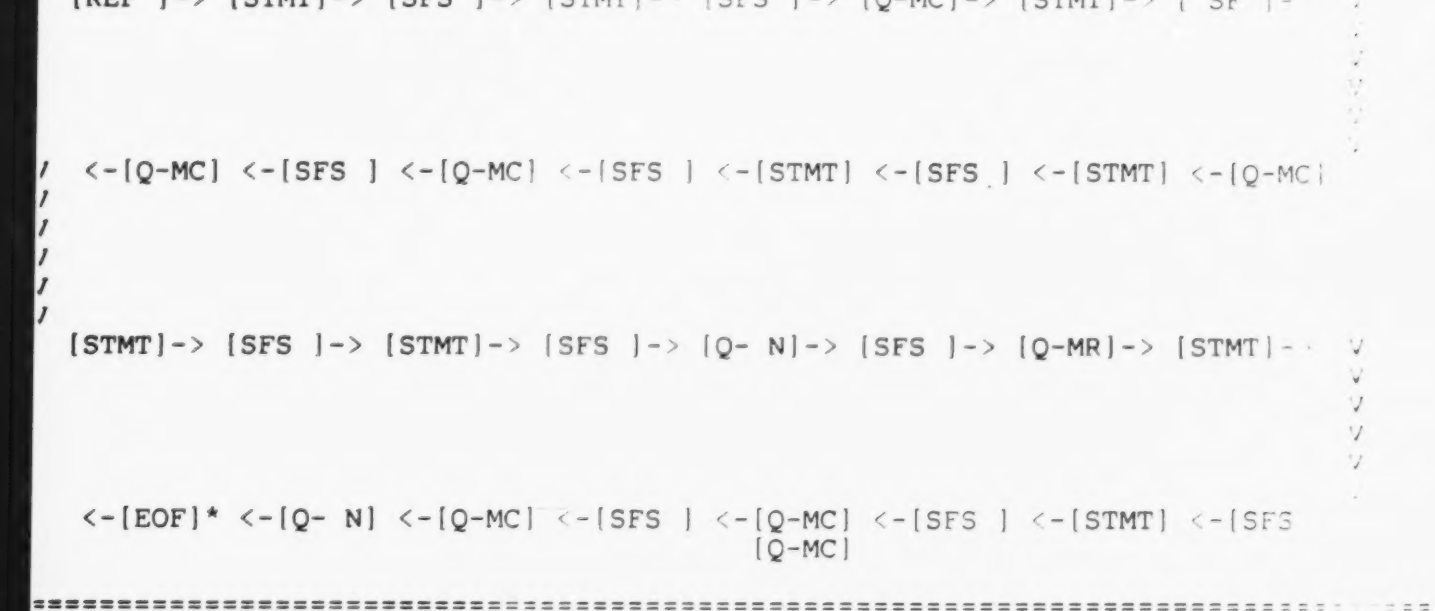
[GS-T] Graphic screen with "text".

[GS-Q] Graphic screen with question.

[REF] Reference Section

[EOF]* End of file.

SEQUENCE OF OPTIONS SELECTED FOR FILE profile.[d2]<tue>roc



PROFILE OF FILE [D2]<WED>FORTE.WEATHERING

NUMBER OF LINES IN FILE :537
NUMBER OF SECTIONS IN FILE: 44

FREQUENCY & PERCENT OF COMMANDS USED IN FILE

FREQ OPTION

```
  1   [SFS ]   |*
 15   [ SF ]   |****************
  0   [BR-C]   |
  0   [BR-U]   |
 15   [STMT]   |****************
  3   [Q-MR]   |***
  1   [Q-MC]   |*
  9   [Q- N]   |**********
  0   [GS-T]   |
  0   [GS-Q]   |
  1   [REF ]   |*
               ----+----+----+----+----+----+----+----+----+----+
               0                        50                      100
                                    PERCENT
```

LEGEND

[SFS] A frame sequence(presentation).

[SF] One or more single frames.

[BR-C] Conditional branch.

[BR-U] Unconditional branch

[STMT] Statement(instruct or explain).

[Q-MR] Multiple response question.

[Q-MC] Multiple choice question.

[Q- N] Open ended question.

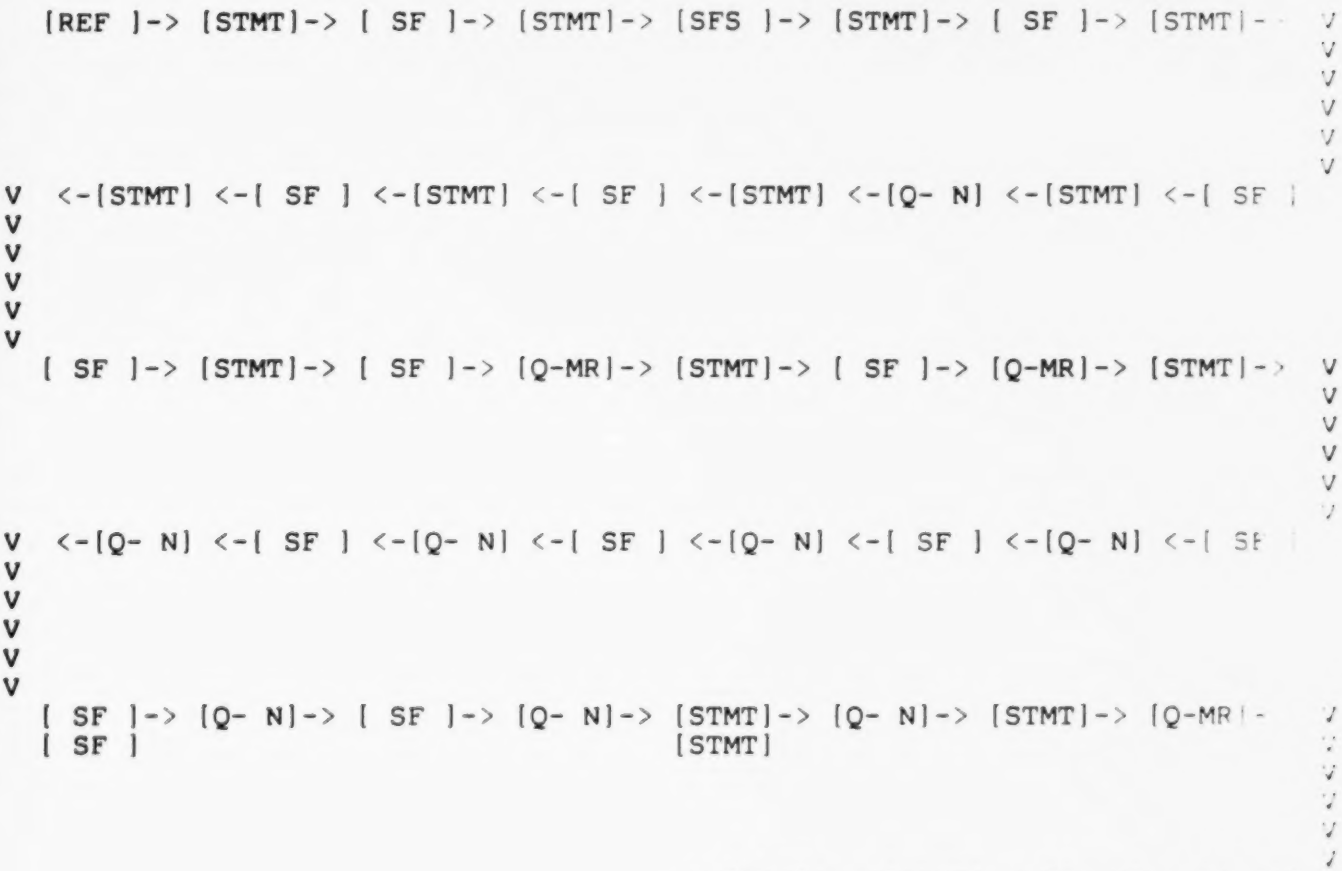
[GS-T] Graphic screen with "text".

[GS-Q] Graphic screen with question.

[REF] Reference Section

[EOF]* End of file.

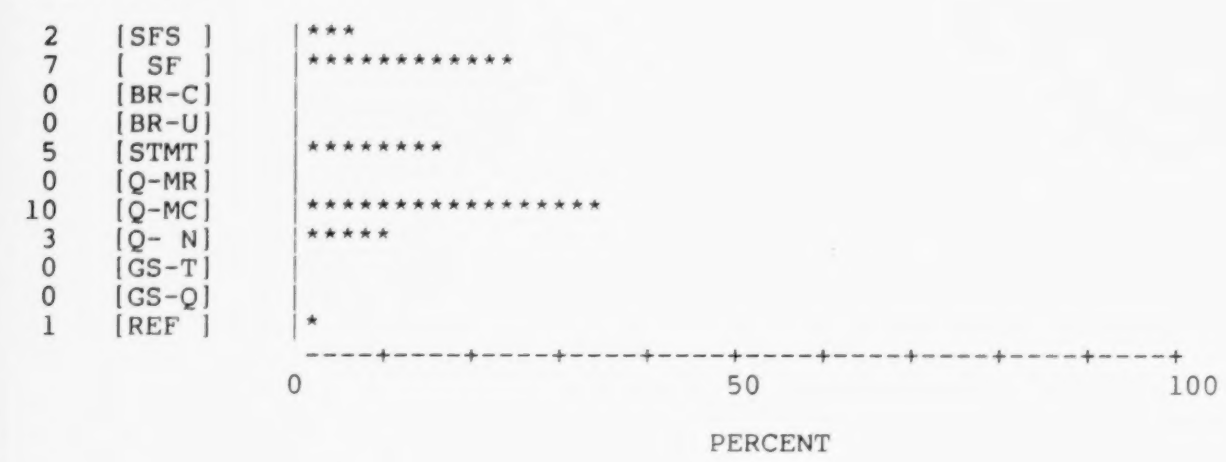
SEQUENCE OF OPTIONS SELECTED FOR FILE profile.[D2]<WED>FOR


[REF]-> [STMT]-> [SF]-> [STMT]-> [SFS]-> [STMT]-> [SF]-> [STMT]-
<-[STMT] <-[SF] <-[STMT] <-[SF] <-[STMT] <-[Q- N] <-[STMT] <-[SF
[SF]-> [STMT]-> [SF]-> [Q-MR]-> [STMT]-> [SF]-> [Q-MR]-> [STMT]->
<-[Q- N] <-[SF] <-[Q- N] <-[SF] <-[Q- N] <-[SF] <-[Q- N] <-[SF
[SF]-> [Q- N]-> [SF]-> [Q- N]-> [STMT]-> [Q- N]-> [STMT]-> [Q-MR]-
[SF] [STMT]
<-[EOF]* <-[STMT] <-[Q- N] <-[Q-MC]

PROFILE OF FILE [D2]<TUE>TS.REFRACTION

NUMBER OF LINES IN FILE :480
NUMBER OF SECTIONS IN FILE: 27

FREQUENCY & PERCENT OF COMMANDS USED IN FILE



LEGEND

[SFS] A frame sequence(presentation).

[SF] One or more single frames.

[BR-C] Conditional branch.

[BR-U] Unconditional branch

[STMT] Statement(instruct or explain).

[Q-MR] Multiple response question.

[Q-MC] Multiple choice question.

[Q- N] Open ended question.

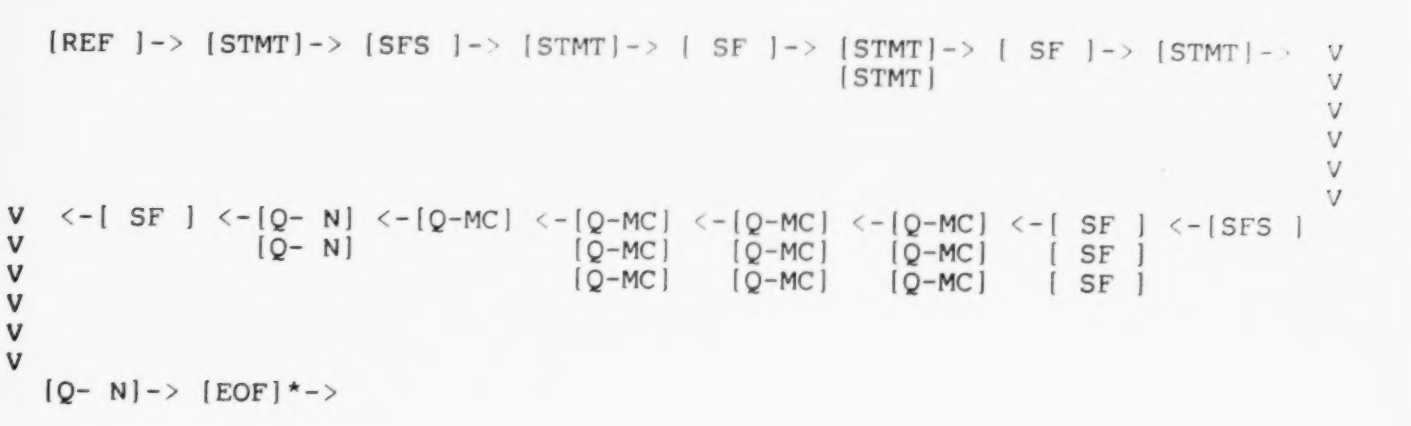
[GS-T] Graphic screen with "text".

[GS-Q] Graphic screen with question.

[REF] Reference Section

[EOF]* End of file.

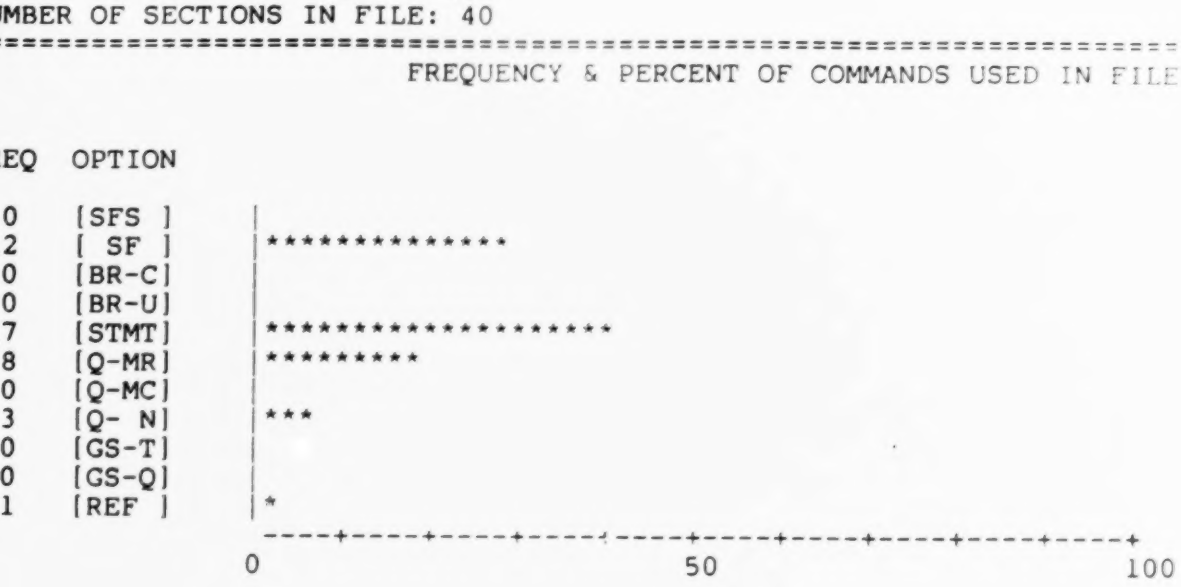
SEQUENCE OF OPTIONS SELECTED FOR FILE profile.[D2]<TUE>TS.



PROFILE OF FILE [D2]<TUE>CP.VOLCANISM

NUMBER OF LINES IN FILE :536
NUMBER OF SECTIONS IN FILE: 40

FREQUENCY & PERCENT OF COMMANDS USED IN FILE



LEGEND

[SFS] A frame sequence(presentation).

[SF] One or more single frames.

[BR-C] Conditional branch.

[BR-U] Unconditional branch

[STMT] Statement(instruct or explain).

[Q-MR] Multiple response question.

[Q-MC] Multiple choice question.

[Q- N] Open ended question.

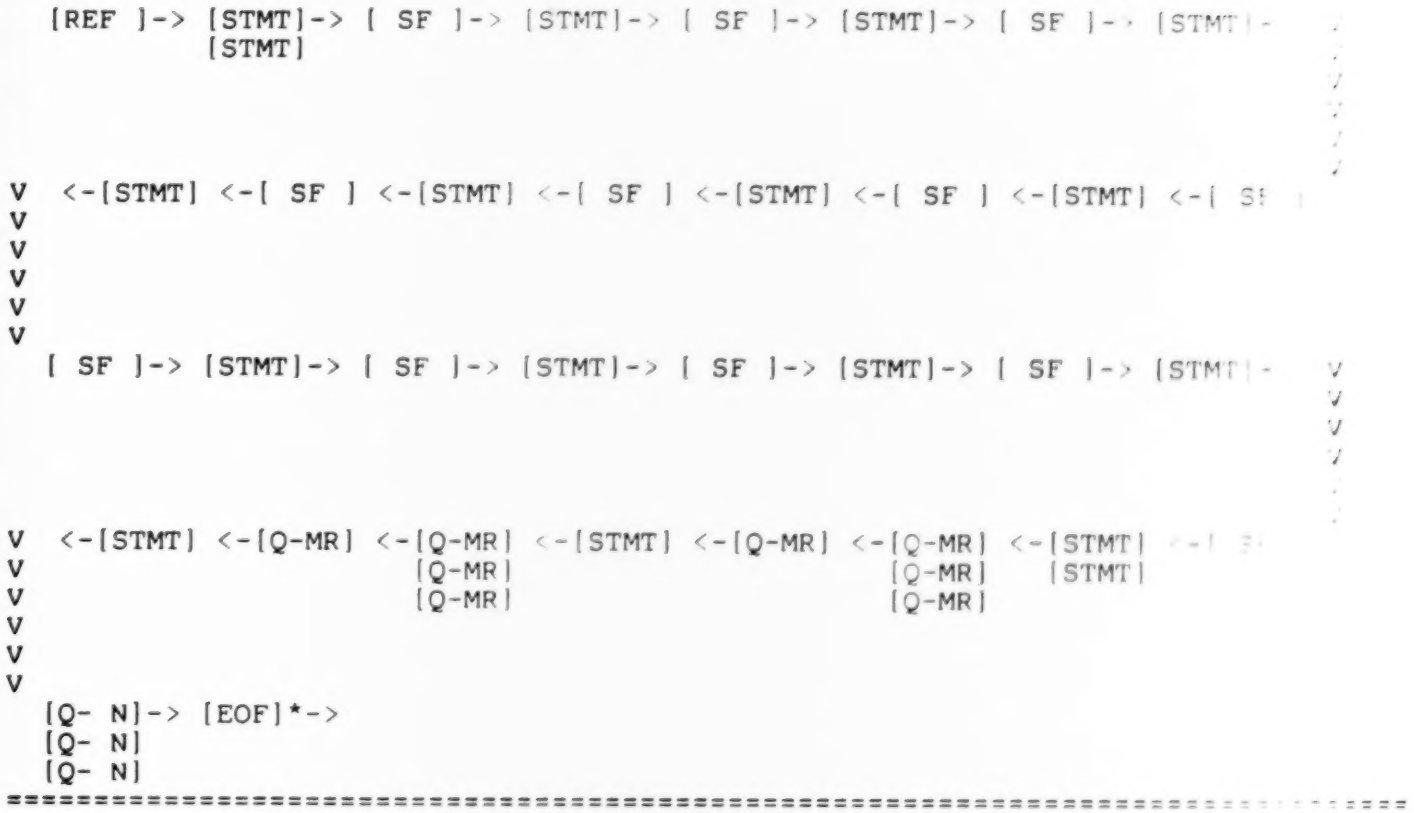
[GS-T] Graphic screen with "text".

[GS-Q] Graphic screen with question.

[REF] Reference Section

[EOF]* End of file.

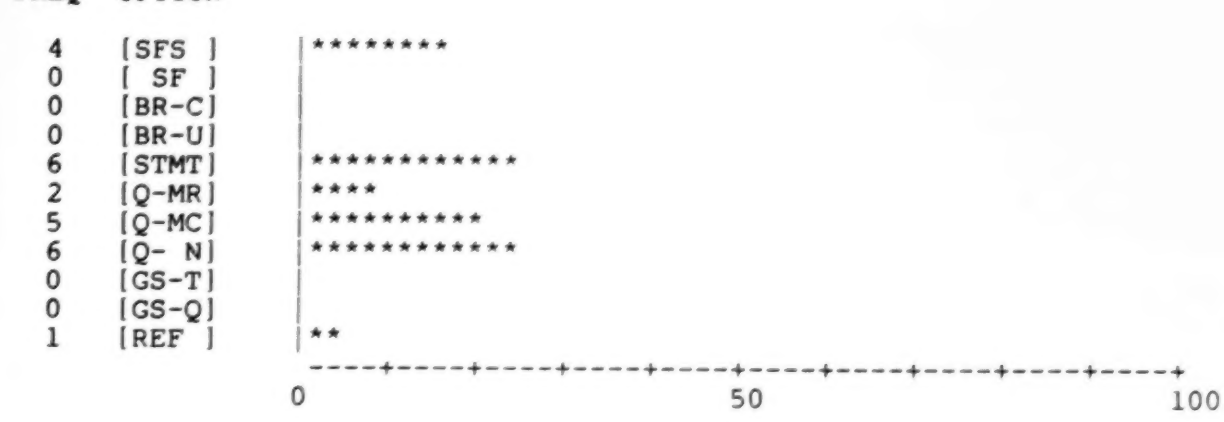
SEQUENCE OF OPTIONS SELECTED FOR FILE profile.[D2]<TUE>CP.



PROFILE OF FILE [D2]<TUE>LM.CIRCULATION

NUMBER OF LINES IN FILE :417
NUMBER OF SECTIONS IN FILE: 23

FREQUENCY & PERCENT OF COMMANDS USED IN FILE



LEGEND

[SFS] A frame sequence(presentation).

[SF] One or more single frames.

[BR-C] Conditional branch.

[BR-U] Unconditional branch

[STMT] Statement(instruct or explain).

[Q-MR] Multiple response question.

[Q-MC] Multiple choice question.

[Q- N] Open ended question.

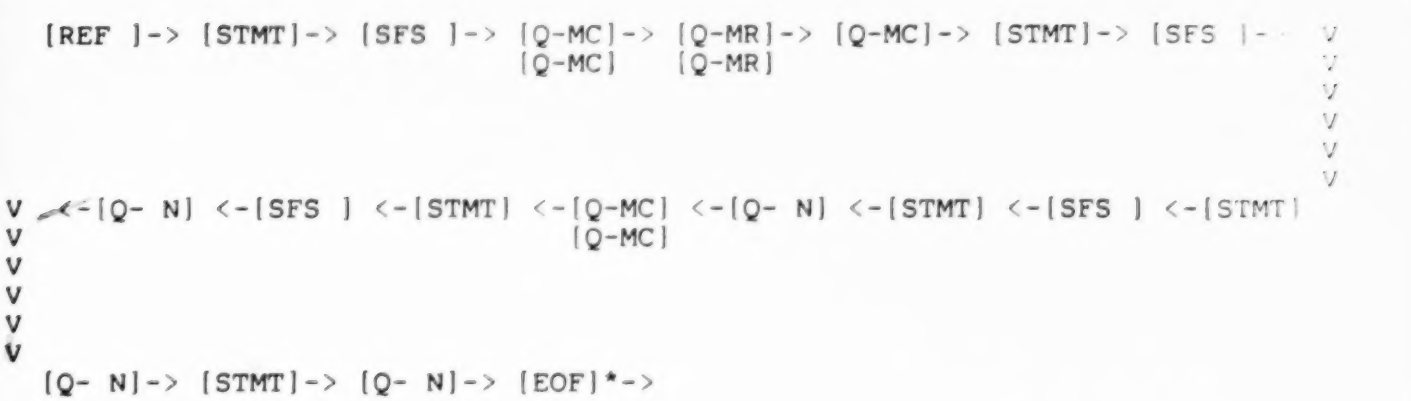
[GS-T] Graphic screen with "text".

[GS-Q] Graphic screen with question.

[REF] Reference Section

[EOF]* End of file.

SEQUENCE OF OPTIONS SELECTED FOR FILE profile.[D2]<TUE>LM.



REPRESENTATIVE DATA ANALYSIS

ENTRIES FOR margaret [redacted]

==========QUESTION 1 MULTIPLE CHOICE======
2=CORRECT ANSWER
2=CHOICE SELECTED
==========QUESTION 2 MULTIPLE CHOICE======
4=CORRECT ANSWER
4=CHOICE SELECTED
==========QUESTION 4 MULTIPLE CHOICE======
3=CORRECT ANSWER
3=CHOICE SELECTED
==========QUESTION 6 OPEN ENDED ==========
granite is light in color, with large crystals. This is because it cools slowly. This gives it a coarse texture.

---WORDSEARCH RESULTS---
4=Matches needed
4=Matches found
==========QUESTION 7 MULTIPLE RESPONSE====
3=PREFERRED ANSWER
3=CHOICE SELECTED
==========QUESTION 8 MULTIPLE CHOICE======
4=CORRECT ANSWER
4=CHOICE SELECTED
==========QUESTION 9 MULTIPLE CHOICE======
2=CORRECT ANSWER
2=CHOICE SELECTED
==========QUESTION 10 MULTIPLE CHOICE======
2=CORRECT ANSWER
2=CHOICE SELECTED
==========QUESTION 11 OPEN ENDED ==========
I believe that this program could best be improved by the addition of more questions. The questions used were quite good, and were covered in thee presentation, but the answering of so few questions for such a great body of material would not be represent[illegible] of student knowledge. Another problem was the number of viewings included as part of the body of the program. Since the student already has the opportunity to view the film again, I don't belie[illegible] so many viewings were necessary.

--- *$END OF RESPONSES ---
8 QUESTIONS REQUIRED A CORRECT OR INCORRECT RESPONSE
8 CORRECT RESPONSES WERE GIVEN

REPLIES TO MULTIPLE CHOICE AND MULTIPLE
RESPONSE QUESTIONS ARE INDICATED BY DIGITS.
OPEN ENDED QUESTIONS ARE INDICATED BY A
PERIOD.

NAME	RESPONSES TO QUESTIONS ONE TO FIFTY
tom [redacted]	24 3 .4422.
mary [redacted]	24 3 .4422.
forte	24 3 .3422.
margaret w	24 3 .3422.
christine	24 3 .3222.
donald [redacted]	24 3 .3422.
cathleen p	24 3 .3422.
julia [redacted]	24 3 .3422.
laura [redacted]	24 3 .3422.
mary [redacted]	24 3 .3222.
mark [redacted]	24 3 .3422.
Tosa [redacted]	24 3 .3422.
jacqueline	22 3 .3422.
gary [redacted]	24 3 .3422.
claudia [redacted]	24 3 .1432.
John [redacted]	24 3 .3422.

```
ONLY QUESTIONS REQUIRING CORRECT OR
INCORRECT RESPONSES WILL BE LISTED
-------------------------------------------
SUMMARY OF RESPONSES FOR FILE  ROCKS

Total number of questions    =  11
Total number of respondents =  16

QUESTION   1
total # of responses =  16
# correct responses  =  16
percentage correct   = 100

QUESTION   2
total # of responses =  16
# correct responses  =  15
percentage correct   =  93

QUESTION   4
total # of responses =  16
# correct responses  =  16
percentage correct   = 100

QUESTION   6
total # of responses =  16
# correct responses  =   5
percentage correct   =  31

QUESTION   7
total # of responses =  16
# correct responses  =  13
percentage correct   =  81

QUESTION   8
total # of responses =  16
# correct responses  =  14
percentage correct   =  87

QUESTION   9
total # of responses =  16
# correct responses  =  15
percentage correct   =  93

QUESTION  10
total # of responses =  16
# correct responses  =  16
percentage correct   = 100

-------------------------------------------
HIGHEST SCORE = 100
LOWEST  SCORE =  31


   7.0 = median
     4 = # above median
    12 = # equal or below median
   6.9 = mean
     7 = mode
```

FOR EACH ITEM, PERCENTAGES ARE LISTED FOR
CHOICES 1 TO 9. THE NUMBER OF RESPONSES
TO THAT ITEM IS LISTED UNDER "TOTAL"

ITEM	1	2	3	4	5	6	7	8	9	TOTAL
1	0	100	0	0	0	0	0	0	0	16
2	0	6	0	93	0	0	0	0	0	16
3	0	0	0	0	0	0	0	0	0	0
4	0	0	100	0	0	0	0	0	0	16
5	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0
7	6	0	81	12	0	0	0	0	0	16
8	0	12	0	87	0	0	0	0	0	16
9	0	93	6	0	0	0	0	0	0	16
10	0	100	0	0	0	0	0	0	0	16

CHI-SQUARE ANALYSIS OF MULTIPLE
CHOICE QUESTIONS FROM FILE output.rocks
(LIMIT OF 150 QUESTIONS MAXIMUM)

(2 TO 9 [illegible] IN A QUESTION)

OBSERVED FREQUENCIES FOR QUESTION 1

1	2	3	4	TOTAL
0	16	0	0	16.0

Degrees of Freedom = 3
Chi-square computed = 48.0
Chi-square table(.05%)= 7.8
SIGNIFICANT AT .05%

OBSERVED FREQUENCIES FOR QUESTION 2

1	2	3	4	TOTAL
0	1	0	15	16.0

Degrees of Freedom = 3
Chi-square computed = 40.5
Chi-square table(.05%)= 7.8
SIGNIFICANT AT .05%

OBSERVED FREQUENCIES FOR QUESTION 3

1	2	3	4	TOTAL
0	0	16	0	16.0

Degrees of Freedom = 3
Chi-square computed = 48.0
Chi-square table(.05%)= 7.8
SIGNIFICANT AT .05%

OBSERVED FREQUENCIES FOR QUESTION 4

1	2	3	4	TOTAL
0	2	0	14	16.0

Degrees of Freedom = 3
Chi-square computed = 34.0
Chi-square table(.05%)= 7.8
SIGNIFICANT AT .05%